VENETIAN BLIND WITH VARIABLE TILTING

BACKGROUND OF INVENTION

1. Field of the Invention

This invention relates to a venetian blind, the slats of which can be tilted to different angles relative to one another (i.e., variably tilted). When the slats of such a blind have been tilted, so that they are closed in a normal fashion, the slats of a lower portion of the blind, in front of a room window, can be tilted to an open position to provide a view of the outside, while at the same time, the slats of the blind's upper portion can be left tilted in a closed position to reduce the amount of sunlight coming into the room. Alternatively, an upper portion of the blind can be tilted to an open position to admit some sunlight into the room, while at the same time, the slats of the blind's lower portion can be left tilted in a closed position to provide privacy in the room and/or reduce the amount of sunlight in the room, for example to prevent glare from interfering with the use of computer or television screens in the room.

2. Description of the Art

Venetian blinds have generally included: a horizontally-elongated head rail; a plurality of horizontally-elongated slats beneath the head rail and parallel to it; and at least two slat-supporting ladders movably suspended from the head rail and supporting the slats in vertically spaced apart relationship. In this regard, each ladder generally has had front and rear, vertically-extending members that have been connected to each other by a plurality of vertically-spaced cross-rungs. Supported on each cross-rung, between the vertically-extending members of its ladder, has been one length-wise side of a slat. The head rail generally has had an adjusting mechanism for moving the ladders, so that the vertically-extending members of each ladder move in opposite vertical directions relative to one another, to pivot each slat about its length-wise axis.

It has also been known to provide a venetian blind with a vertically-extending auxiliary tilt cord to provide variable tilting of its slats. The auxiliary tilt cord has been adapted to engage at least one of the vertically-extending members of the blind's ladders, at an intermediate location along its height, and when manipulated, to adjust the angle of pivot of the slats below the intermediate location. See U.S. Pat. Nos. 2,427,266, 2,719,586, 2,751,000, 4,940,070, EP 0 620 355 and JP(A) 8-210060. Although such a blind has been reasonably successful in providing a room with both privacy and some sunlight, the blind has generally been rather complicated to manufacture and use.

SUMMARY OF THE INVENTION

In accordance with this invention, a venetian blind is provided which includes a plurality of horizontally-elongated slats; at least two ladders supporting the slats in vertically spaced apart relationship; an adjusting mechanism for moving the vertical members of each ladder in opposite vertical directions, relative to one another, to pivot each slat about its length-wise axis; and an auxiliary tilt cord which can be moved vertically and can engage a vertically-extending member of one of the ladders at an intermediate location along the height of the one ladder; and wherein a plurality of regularly-spaced guiding loops are along the height of the one ladder; and wherein the auxiliary tilt cord comprises:

a plurality of regularly spaced beads along its length; and

an engaging collar that is mounted about the auxiliary tilt cord and between a predetermined pair of adjacent guiding loops and that is adapted to be engaged by each of the beads; and

wherein each of the guiding loops is adapted to be engaged by the engaging collar, while the beads are adapted to pass through the loops unobstructed if not prevented from doing so by the engaging collar.

This blind with variable tilting of its slats is easier to assemble and operate and can also be made somewhat less expensively.

Advantageously, this blind also includes: means for adjusting the angular pivot of the slats, below the intermediate location along the height of the one ladder, which comprises:

a drum, connected to the adjusting mechanism, for winding the auxiliary tilt cord only after the adjusting mechanism has fully pivoted each slat in one of two opposite directions about its length-wise axis.

Also in accordance with this invention, a venetian blind is provided which includes a plurality of horizontally-elongated slats; at least two ladders supporting the slats in vertically spaced apart relationship; an adjusting mechanism for moving the vertical members of each ladder to move in opposite vertical directions, relative to one another, to pivot each slat about its length-wise axis; and an auxiliary tilt cord which engages a vertically-extending member of one of the ladders at an intermediate location along the height of the one ladder; and which also includes means for adjusting the angular pivot of the slats below the intermediate location along the height of the one ladder, comprising:

a drum, connected to the adjusting mechanism, for winding the auxiliary tilt cord only after the adjusting mechanism has fully pivoted each slat in one of two opposite directions about its length-wise axis.

Advantageously, this blind also includes a plurality of regularly-spaced guiding loops along the height of the one ladder; and the auxiliary tilt cord comprises:

a plurality of regularly spaced beads along its length; and

an engaging collar that is mounted about the auxiliary tilt cord and between a predetermined pair of adjacent guiding loops and that is adapted to be engaged by each of the beads; and

wherein each of the guiding loops is adapted to be engaged by the engaging collar, while the beads are adapted to pass through the loops unobstructed if not prevented from doing so by the engaging collar.

BRIEF DESCRIPTION OF THE DRAWINGS

Further aspects of the invention will be apparent from the detailed description below of specific embodiments and the drawings thereof, in which:

FIG. 1 is a partial perspective view of a front side (e.g., facing a room) of a venetian blind of this invention;

FIG. 2 is a partial perspective view of a rear side (e.g., facing a window) of the blind of FIG. 1, showing auxiliary tilt cords associated with vertical members of its slat-supporting ladders;

FIG. 3 is an enlarged perspective detail view of a portion of the rear of the blind of FIG. 1 on the blind's left side (as viewed from its front as in FIG. 1);

FIG. 4 is an enlarged perspective view of a top portion of the rear of the blind of FIG. 1 on its left side, with its head rail partly broken away to show its internal mechanisms;

FIG. 5 is a partial elevation view showing a top portion of the left side of the head rail of the blind of FIG. 1;

FIG. 6 is a side elevation view of a second embodiment of a venetian blind of this invention, viewed from the blind's left side; and

FIG. 7 is a side elevation view of a third embodiment of a venetian blind of this invention, viewed from the blind's left side.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

FIGS. 1–5 show a first embodiment of a venetian blind **1** of this invention. As best seen in FIG. **1**, the blind **1** has a generally conventional, horizontallyextending head rail **3**, horizontally-extending bottom rail (not shown) and pair of vertically-extending slat-supporting ladders **5** and **7**. The ladders **5**, **7** are suspended from the head rail **3** in a conventional manner so as to be movable by a pair of tilt pivot swivels **9** and **11**, respectively, in the head rail. As will be described in detail below with reference to FIGS. **2**, **3** and **5**, the ladders **5**, **7** hold a plurality of conventional horizontally-elongated slats **13**, so that they are suspended horizontally from the head rail **3**. A conventional, manually operable, cord loop **8** is suspended from the front of the head rail **3**. The cord loop **8** is connected to the tilt swivels **9**, **11** in the head rail **3**. The tilt swivels **9**, **11** can move the front and rear of the ladders **5**, **7**, relative to each other, to adjust the angular position or tilt of all the slats **13** (i.e., pivot the slats about their longitudinal axes) in response to movement of the cord loop **8**.

FIGS. **2** and **3** show best a pair of vertically-extending auxiliary tilt cords **14**, **15** at the rear of the blind **1** and a first or rear, vertical member **17**, **19** and a second or front, vertical member **18**, **20** of each ladder **5**, **7** of the blind. The rear and front vertical members **17–20** extend parallel to each other and are interconnected by a plurality of laterally-extending cross-rungs **29** (see FIG. **3**). The cross-rungs **29** are spaced vertically apart along the height of the vertical members **17–20** of the ladders **5**, **7** at a regular pitch (which is the distance between two vertically adjacent slat supporting rungs **29**).

Each vertically-extending auxiliary tilt cord **14**, **15** is located adjacent the rear vertical member **17**, **19** of one of the ladders **5**, **7**, respectively. Each tilt cord **14**, **15** is connected to, and engages, its adjacent rear vertical member **17**, **19** at a plurality of predetermined intermediate locations along the height of the tit cord and its adjacent rear vertical member. In this regard:

- a plurality of rearwardly-extending guiding loops or eyelets **21** are fixed on each rear vertical member **17**, **19** along its height and extend about its adjacent auxiliary tilt cord **14**, **15**;
- a plurality of beads **23** are fixed on each auxiliary tilt cord **14**, **15**, along its height; and
- a plurality of engaging collars **25** are slidably located on each auxiliary tilt cord **14**, **15**, along its height, each collar **25** being located between a selected pair of vertically adjacent guiding loops **21** on the adjacent rear vertical member **17**, **19** and above a bead **23** on the auxiliary tilt cord.

The plurality of guiding loops **21** are preferably regularly spaced along the height of each rear vertical member **17**, **19**, and the plurality of beads **23** are preferably regularly spaced along the height of each auxiliary tilt cord **14**, **15**. The vertical spacing or pitch ($P_{(beads)}$) of the regularly spaced beads **23** along each auxiliary tilt cord **14**, **15** is preferably the same and preferably slightly less than the pitch ($P_{(rungs)}$) of the cross-rungs; for example: $P_{(beads)}=P_{(rungs)}-1$ or an integral multiple (X_1) thereof (i.e., $X_1*(P_{(rungs)}-1)$. The pitch ($P_{(loops)}$) of the regularly spaced guiding loops **21** along each auxiliary tilt cord is also preferably the same and is preferably the same absolute value as $P_{(rungs)}$, but it can also be an integral multiple (X_2) thereof (i.e., $P_{(loops)}=X_2*P_{(rungs)}$). The locations of the cross-rungs **29** and the locations of intermediate guiding loops **21**, between the top and bottom of the rear vertical members **17**, **19**, preferably do not coincide horizontally, and preferably, the integral values of X_1 and X_2 are identical.

The number of guiding loops **21** on each of the rear vertical members **17**, **19** is preferably the same, and each guiding loop on each of the rear vertical members **17**, **19** is preferably aligned horizontally with a guiding loop on the other rear vertical member(s). The number of beads **23** on each of the auxiliary tilt cords **14**, **15** is preferably the same, and each bead on each of the auxiliary tilt cords is preferably aligned horizontally with a bead on the other auxiliary tilt cord(s). The number of engaging collars **25** on each of the auxiliary tilt cords **14**, **15** is also preferably the same, and each collar **25** on each of the auxiliary tilt cords **14**, **15** is preferably aligned horizontally with a collar on the other auxiliary tilt cord(s). The number of beads **23** spaced along each of the auxiliary tilt cords **14**, **15** is equal to, or greater than, preferably equal to, the number of engaging collars **25** spaced along the auxiliary tilt cord.

The rearwardly-extending guiding loops **21** on the rear vertical members **17**, **19** of the ladders **5**, **7** keep the auxiliary tilt cords **14**, **15** and the rear vertical members in close proximity to each other. In particular, the guiding loops **21** of each rear vertical member **17**, **19** prevent the adjacent auxiliary tilt cord **14**, **15**, respectively, around which the guiding loops extend, from forming unsightly loops when the blind **1** is raised or from becoming entangled during use of the blind. When $P_{(loops)}$ equals $P_{(rungs)}$, the number of loops **21** equals the number of cross-rungs **29**. This is illustrated in FIGS. **2**, **3** where, between each adjacent pair of cross-rungs **29** of each ladder **5**, **7**, one guiding loop **21** is provided. The greater the number of loops **21**, the better the auxiliary tilt cords **14**, **15** are held to the rear vertical members **17**, **19** during operation of the blind **1**.

Preferably, each engaging collar **25**, slidably located on an auxiliary tilt cord **14**, **15**, has a generally circular horizontal cross-section. Each collar also has a central vertically-extending passage **27**, through which its auxiliary tilt cord can pass vertically but not the beads **23** on its auxiliary tilt cord. Each collar **25** further has a radially inwardly-extending vertical slit **28** which opens into its central passage **27**. During assembly of the blind **1**, one of the auxiliary tilt cords **14**, **15** can be pushed through the slit **28** of each collar into its central passage **27**. Each collar **25** also has a horizontal circumference greater than each guiding loop **21**, so that the exterior size of the collar **25** is too large for the guiding loops **21** to pass vertically over the collar. However, the guiding loops **21** each have a diameter greater than the horizontal circumference of each bead **23**, so that the beads can pass vertically through the guiding loops.

When the slats **13** of the blind **1** have been closed in a normal fashion (i.e., are downwardly-inclined from front to rear) and the rear vertical members **17**, **19** are stationary, moving upwardly both the auxiliary tilt cords **14**, **15**, with their beads **23**, causes the tilt cords to slide freely upwardly through the central passages **27** of their engaging collars **25** until their upwardly moving beads **23** engage their collars that are directly above their beads. Before the beads **23** on

the auxiliary tilt cords **14, 15** reach their engaging collars **25**, their beads can pass through one or more guiding loops **21** around the auxiliary tilt cords. Continued upward movement of the auxiliary tilt cords **14, 15** and their beads **23** then causes their collars **25** to move upwardly, with the tilt cords and beads, into engagement with the guiding loops **21** that are directly above their collars. This happens because the central passages **27** in the collars **25** are too small to allow the beads **23** on the auxiliary tilt cords **14, 15** to pass through them, and the exterior size of each collar **25** does not allow it to pass through the guiding loops **21**.

If the blind **1** had only a single engaging collar **25** on each auxiliary tilt cord **14, 15**, the blind would have two sections of slats **13**, the lower one of which would be operated by the auxiliary tilt cords **14, 15**. When the auxiliary tilt cords **14, 15** are raised (e.g., by pulling on the rear of the cord loop **8**), their beads **23** beneath their engaging collars **25** would be moved upwardly until they engage and lift their collars **25**, which would then slide upwardly along the tilt cords until they engage the adjacent next higher loops **21** on the adjacent rear vertical members **17, 19** of the ladders **5, 7**. When the auxiliary tilt cords would continue thereafter to be lifted, the collars would then move upwardly, thereby lifting the next higher loops **21** and the portions of the rear vertical members **17, 19** below the next higher loops **21**. This would move upwardly the rear of all the slats **13** below such next higher loops **21**, so as to tilt all the slats below the next higher loops **21** from their normal closed position (i.e., downwardly-inclined from front to rear) toward their open position (i.e., horizontal). The slats **13** below the next higher loops **21** would then have a smaller tilt angle than the slats above the next higher loops **21**. This would be due to the relative difference in pitch between the crossrungs ($P_{(rung)}$) and that of the beads ($P_{(beads)}$). If the auxiliary tilt cords continue to be further lifted, all the slats **13** of the lower section of the blind, below such next higher loops **21**, would continue to be so-tilted until they would be completely open.

In the blind **1** of FIGS. **1–5**, there are two engaging collars **25** on each auxiliary tilt cord **14, 15**, and the blind has three sections of slats **13**, the lower and middle sections of slats **13A, 13B** of which are operated by the auxiliary tilt cords **14, 15**. The slats of the lower section **13A** of the blind **1** of FIGS. **1–5** can be tilted relative to the slats of the middle and upper sections **13B, 13C** by moving the auxiliary tilt cords **14, 15** upwardly together (e.g., by pulling on the rear of the cord loop **8**), so that the lower bead **23A** of each tilt cord moves upwardly and engages the tilt cord's lower engaging collar **25A** (above the lower bead **23A**), which then slides upwardly along the tilt cord until it engages the tilt cord's first adjacent, next higher loop **21A** of its adjacent rear vertical member **17, 19** of the ladders **5, 7** and then lifts the rear of all the slats **13** of the lower section **13A** below this first next higher loop **21A**. When the blind **1** is closed, this movement of the auxiliary tilt cords **14, 15** upwardly causes all the slats of the lower section **13A** (below the first next higher loops **21A**) to be tilted from their normal closed position toward their open position. The slats below the first next higher loops **21A** would then have a smaller tilt angle than the slats above the first next higher loops **21A**.

If the tilt cords **14, 15** of the blind **1** are thereafter moved further upwardly, an upper bead **23B** of each tilt cord moves further upwardly and engages the tilt cord's upper engaging collar **25B** (above the upper bead **23B**), which then slides upwardly along the tilt cord until it engages the tilt cord's second adjacent, next higher loop **21B** of its adjacent rear vertical member **17, 19** of the ladders **5, 7** and then lifts the rear of all the slats **13** of the middle section **13B** below the second next higher loop **21B**. This causes all the slats of the middle section **13B** (below the second next higher loops **21B**) to be tilted from their normal closed position toward their open position and causes all the slats of the lower section **13A** to be further tilted toward their open position. The slats **13** of the lower section **13A**, below the first next higher loops **21A**, would then have a smaller tilt angle than the slats between the first and second next higher loops **21A, 21B**, and the slats of the middle section **13B**, between the first and second next higher loops **21A, 21B**, would then have a smaller tilt angle than the slats of the upper section **13C**, above the second next higher loops **21B**.

If the auxiliary tilt cords **14, 15** of the blind large then moved still further upwardly, all the slats **13** of the lower and middle sections **13A, 13B**, below the second next higher loops **21B**, would continue to be so-tilted until they would be completely open. However, the slats of the upper section **13C** would remain in a normal closed position. If the auxiliary tilt cords **14, 15** are thereafter moved yet further upwardly, all the slats of the lower and middle sections **13A, 13B**, below the second next higher loops **21B**, would continue to be so-tilted until they would be in an abnormal closed position (i.e., downwardly-inclined from rear to front). Although the slats of the upper section **13C** would still remain in a normal closed position, they could be opened simply by then moving the rear vertical members **17, 19** of the ladders **5, 7** downwardly together (e.g., by pulling on the front of the cord loop **8**).

If desired, more than two engaging collars **25** and two beads **23** could be provided on each auxiliary tilt cord **14, 15**. Thereby, the blind **1** would have more than three sections of slats **13** (between engaging collars **25**) which could be progressively tilted to greater angles of openness, relative to one another, so as to provide a more gradual change in the tilting of the slats over the height of the blind.

As shown in FIG. **1**, the blind **1** has a first or left (as viewed in FIG. **1**), tilt swivel **9** and a second or right (as viewed in FIG. **1**), tilt swivel **11** in the head rail **3** for moving its left and right ladders **5, 7** to tilt its horizontal slats **13**. In this regard, the slats can be tilted by moving the interconnected, rear and front, vertical members **17, 18** and **19, 20** of the ladders **5, 7** in a conventional manner in opposite vertical directions, to alter the angular orientation of the ladders' crossrungs **29**. Each of the slats **13** is supported on a confronting one of the crossrungs **29**, between the rear and front, vertical members of each ladder, and thereby is pivoted by each tilt swivel **9, 11** to the same angular position as the pair of crossrungs **29** which support it.

FIG. **4** shows the left tilt swivel **9** which, in accordance with this invention, can both: i) move the rear and front, vertical members **17, 18** of the left ladder **5** in opposite vertical directions to pivot fully its cross-rungs **29** and the left side of the slats **13** thereon between the front and the rear of the blind **1**; and ii) move vertically the left auxiliary tilting cords **14**. The left tilt swivel **9** has a conventional adjusting pulley **31** which rotates about the longitudinal axis of the head rail **3** in response to vertical movement of the cord loop **8**. About the axis of rotation of the adjusting pulley **31** is a V-shaped annular groove **32** which, as shown, converges from the perimeter of the pulley towards it axis. The rear and front, vertical members **17, 18** of the left ladder **5** are connected by a conventional loop **33** of the material of the rear and front, vertical members which passes closely around the adjusting pulley **31** within its V-shaped annular groove **32**. The annular groove **32** frictionally engages the loop **33**, so that the rear and front, vertical members **17, 18**

move vertically in opposite directions, with rotation of the adjusting pulley **31**, between the normal closed and abnormal closed positions of the slats **13**.

FIG. **4** also shows that the left tilt swivel **9** has a conventional winding drum **34** that is connected to, and coaxial with, the adjusting pulley **31**. The winding drum **34** rotates about the longitudinal axis of the head rail **3** with rotation of the adjusting pulley **31**, so that the left auxiliary tilt cord **14** is wound about the winding drum. The left auxiliary tilt cord **14** is fastened to the winding drum **34** with sufficient slack, so that: i) the adjusting pulley **31** can fully pivot all the crossrungs **29** and the slats **13** thereon in the direction of closing the slats; and ii) further pivoting movement of the adjusting pulley **31** will start winding of the tilt cord **14** on the. winding drum **34**, so as to raise the beads **23** on the tilt cord. Before one of the beads **23** of the left auxiliary tilt cord **14** reaches the adjacent engaging collar **25** on the tilt cord, the bead can pass through one or more guiding loops **21** around the tilt cord. Further such winding of the left auxiliary tilt cord **14** on the winding drum **34** further lifts the tilt cord **14** and its beads **23** which causes one of the beads to engage a collar **25** on the tilt cord and to lift the collar, so that it slides along the tilt cord until it engages the next higher guiding loop **21** around the tilt cord. Still further such winding of the left auxiliary tilt cord **14** on the winding drum **34** still further lifts the tilt cord **14**, its beads **23** and its engaged collar **25**, as well as the engaged guiding loop **21**, thereby lifting the portion of the rear vertical member **17** of the left ladder **5** below its engaged guiding loop **21**. This causes the cross-rungs **29** and the slats **13** thereon, below the engaged guiding loop, to pivot towards an open position. During such further winding of the left auxiliary tilt cord **14** on the winding drum **34**, rotation of the adjusting pulley **31** with the winding drum does not further raise the rear vertical member **17** of the first ladder **5** because its loop **33** will simply slip about the adjusting pulley **31** within its V-shaped groove **32**.

The right tilt swivel **11** in the head rail **3**, for tilting the horizontal slats **13** by moving the vertical members **19**, **20** of the right ladder **7** in opposite vertical directions, is mechanically identical to the left tilt swivel **9**, and the right tilt swivel **11** operates in the same way as, and together with, the left tilt swivel **9** upon movement of the cord loop **8**.

FIG. **5** shows a conventional worm gearing **35**, connected to the cord loop **8**, for driving a conventional horizontally-elongated tilt rod **37**. The tilt rod **37** extends along the longitudinal axis of the head rail **3** and through the tilt swivels **9**, **11**. The tilt rod **37** rotates upon movement of the cord loop **8**, which makes the worm gearing **35** rotate. Such rotation of the tilt rod **37** causes the adjusting pulley **31** and winding drum **34** also to rotate, thereby raising the rear vertical members **17**, **19** of the ladder **5**, **7**, as well as the auxiliary tilt cords **14**, **15**, so as to open and close the slats **13**. Internal friction in the worm gearing **35** prevents the tilt rod **37** and thereby the adjusting pulley **31** and winding drum **34** from rotating when the cord loop **8** is not being moved so as to rotate the worm gearing.

FIG. **6** shows a second embodiment of a blind **101** of the invention which is similar to the blind **1** of FIGS. **1–5** and for which corresponding reference numerals (greater by 100) are used below for describing the same parts or corresponding parts.

As shown in FIG. **6**, the blind **101** includes: a horizontally-extending head rail **103**; a horizontally-extending bottom rail **104**; a pair of vertically-extending ladders **105**, **107** (not visible in FIG. **6**), each having a rear vertical member **117**, **119** (not visible in FIG. **6**) and a front vertical member **118**, **120** (not visible in FIG. **6**) and a plurality of cross-rungs **129** between its rear and front, vertical members; and a plurality of slats **113** suspended from the head rail on the cross-rungs. A conventional rod-operated tilter **108**, attached to compatible gearing (not shown) in the head rail **103**, replaces the cord loop **8** and worm gearing **35** of the blind **1** of FIGS. **1–5**. In this regard, a suitable tilter and compatible gearing are described in, for example, WO 98/27307, U.S. Pat. Nos. 4,541,468, 3,921,695, 3,918,513 and 3,425,479.

The blind **101** of FIG. **6** features additional laterally-extending cross-rungs **130** between each of the rear vertical members **117**, **119** of the ladders **105**, **107** and one of a pair of auxiliary tilt cords **114**, **115** (not visible in FIG. **6**) which is to the rear of the rear vertical member. The auxiliary tilt cords **114**, **115** are each connected to a separate tilt swivel (not shown) in the head rail which is connected to, and pivots with. a longitudinally-extending tilt rod (not shown) in the head rail that is connected to the gearing of the tilter **108**. The first pitch P1 between each of the cross-rungs **129** (which connect the rear and front vertical members **117**, **118** and **119**, **120** of the ladders **105**, **107**) is slightly greater than the second pitch P2 between each of the additional cross-rungs **130** (which connect the auxiliary tilt cords **114**, **115** and the rear vertical member **117**, **119**). The auxiliary tilt cords **114**, **115** replace the auxiliary tilt cords **14**, **15** of the blind **1** of FIGS. **1–5** and enable the individual slats **113** of the blind **101** to be tilted progressively (rather than by sections of slats as in the blind **1** of FIGS. **1–5**) from the lowermost slat to the uppermost slat, from their normal closed position to an open position, when the auxiliary tilt cords **114**, **115** are moved upwardly by twisting the tilter **108**.

The vertical distance, over which the slats **113** are progressively tilted to an open position is determined by the difference between the first pitch P1 of the cross-rungs **129** and the second pitch P2 of the additional cross-rungs **130**. For example, conventional ladders **105**, **107** for the venetian blind **101**, with 25 mm wide slats **113**, could normally have a first pitch P1 of 20 mm. If such ladders **105**, **107** are modified by the additional cross-rungs **130** connected to the auxiliary tilt cords **114**, **115** at a second pitch P2 of 19 mm, the vertical distance, in terms of the number of slats, between the first fully closed slat **113A** (i.e., the lowest closed slat) and the first fully open slat (i.e., the lowest open slat) will be: the first pitch P1 (i.e., 20 mm), divided by the difference between the first and second pitches (i.e., P1–P2= 20 –19=1 mm), which means that the vertical distance will be twenty slats. A vertical distance of twenty slats of 25 mm lateral width (normally with 5 mm lateral overlap when fully closed) normally corresponds to 400 mm of vertical height of the blind **101**.

When the auxiliary tilt cords **114**, **115** of such a blind **101** (with 25 mm-wide slats) are raised with all the slats **113** tilted in a normal closed position (i.e., downwardly-inclined from front to rear), then initially the lowest slat **113A** will be tilted towards its fully open (i.e., horizontal) position while the nineteen slats (not shown in FIG. **6**) just above the lowest slat will have a gradually less open position of tilt as the height of each slat above the lowest slat becomes greater, and the uppermost slat of the twenty lowest slats of the blind will still be tilted closed, as will the remaining slats (not shown in FIG. **6**) of the blind above the lowest twenty slats. One side effect of this arrangement will be that the lowest slat **113A**, after being fully opened, will be subsequently lifted, together with the bottom rail **104**, by raising further the auxiliary tilt cords **114**, **115** to open further the slats

above the lowermost slat. This side effect of raising the lowermost slat and the bottom rail can be avoided by providing the blind **101** with extra slats **113** and more height, so that all the slats can be opened by moving upwardly the auxiliary tilt cords **114, 115**—without there being an objectionable light gap underneath the bottom rail **104**. The number of additional slats **113**, required for this purpose, is a function of the ratio between the total height H of the blind **101** and the distance over which its slats **113** are to gradually change their tilt position from normal closed to open. In the blind **101** with 25 mm wide slats **113**, a first pitch (P1) of 20 mm (and 5 mm overlap when fully closed), a vertical distance between the lowest fully closed slat and the lowest fully open slat **113A** of 400 mm and a difference between the first and second pitches (P1–P2) of 1 mm, a total height of the blind of 2000 mm requires 2000/400=5 additional slats to prevent the occurrence of a light gap.

The auxiliary tilt cords **114, 115** should be of sufficient lateral length and have sufficient slack so as not to interfere with the basic slat-tilting function of the rear and front, vertical members **117, 118** and **119, 120** of the ladders **105, 107** and their cross-rungs **129**. This requires, inter alia, that there be a minimum lateral length L for the additional cross-rungs **130**, relative to the height H of the blind **101**. The minimum length L for the additional cross-rungs **130** for a given height H of blind is such that when all of the slats **113** of the blind **101** are in an open (i.e., horizontal) position as shown in FIG. **6**, the additional cross-rungs **130A**, connected to the rear vertical members **117, 119** at the lowest slat **113A**, extend upwardly from the rear vertical members and the additional cross-rung **130C**, connected to the rear vertical members at the uppermost slat **113C**, extend downwardly from the rear vertical members.

Furthermore, the lateral length L of each additional cross-rung **130** of the blind **101** should be at least one-half of the total difference in the first and second pitches (i.e., P1–P2) for the maximum height of the blind **101**. The minimum length L of each additional cross-rung **130** is thus one-half of the product of the total number of slats **113**, corresponding to the maximum height of the blind, times the difference in the first and second pitches. For example, if the height of the blind **101** is to be a maximum of 2000 mm, then with a first pitch (P1) of 20 mm, the total number of slats **113** would be one hundred, and with a difference in the first and second pitches (i.e., P1–P2) of 1 mm, the minimum length L of each additional cross-rung would be one-half of 100 mm or 50 mm. Any ladder **105, 107** of the blind **101** of FIG. **6**, which is long enough for the maximum height of the blind, would be equally suitable for any smaller height of the blind.

FIG. **7** shows a third embodiment of a blind **201** of the invention which is similar to the blind **101** of FIG. **6** and for which corresponding reference numerals (greater by 100) are used below for describing the same parts or corresponding parts.

As shown in FIG. **7**, the blind **201** includes: a horizontally-extending head rail **203**; a horizontally-extending bottom rail **204**; a pair of vertically-extending ladders **205, 207** (not visible in FIG. **7**), each having a rear vertical member **217, 219** (not visible in FIG. **7**) and a front vertical member **218, 220** (not visible in FIG. **7**) and a plurality of cross-rungs **229** between its rear and front, vertical members; a plurality of slats **213** suspended from the head rail on the cross-rungs; and rod-operated tilter **208**, attached to compatible gearing (not shown) in the head rail **203**.

The blind **201** of FIG. **7** features a plurality of vertically-aligned tubular elements **230** about each of the rear vertical members **217, 219** of the ladders **205, 207**. Each tubular element **230** is between a different pair of vertically adjacent cross-rungs **229** of one of the ladders **205, 207** and surrounds a section of the rear vertical member **217, 219** of the ladder between its successive cross-rungs. Each tubular element **230** is of a length L that is slightly smaller than the first pitch P1 of the ladders **205, 207**. Each plurality of vertically-aligned tubular elements **230** about one of the rear vertical members **217, 219** of the ladders **205, 207** also surrounds one of the auxiliary tilt cords **214, 215** (not visible in FIG. **7**) to the rear of the one rear vertical member. Each auxiliary tilt cord **214, 215** has an engaging knot **240** at its lowermost end which extends downwardly of the lowermost tubular element **230A**. Each auxiliary tilt cord **214, 215** is of sufficient length and has sufficient slack, so as not to interfere with the normal operation of the blind **201**.

The vertical distance, over which the slats **213** are progressively tilted to an open position is determined by the difference between the pitch P1 of the cross-rungs **229** and the length L of the tubular elements **230**. For example, conventional ladders **205, 207** for the venetian blind **201**, with 25 mm wide slats **213**, could normally have a pitch P1 of 20 mm. If such ladders **205, 207** are modified by the tubular elements **230** on the rear vertical members **217, 219** and the auxiliary tilt cords **214, 215** with a length L of 19 mm, the vertical distance, in terms of the number of slats, between the first fully closed slat **213A** (i.e., the lowest closed slat) and the first fully open slat (i.e., the lowest open slat) will be: the first pitch P1 (i.e., 20 mm), divided by the difference between the pitch P1 and the length L (i.e., 20–19=1 mm), which means that the vertical distance will be twenty slats. A vertical distance of twenty slats of 25 mm lateral width (normally with 5 mm lateral overlap when fully closed) normally corresponds to 400 mm of vertical height of the blind **201**.

When the auxiliary tilt cords **214, 215** of such a blind **201** (with 25 mm-wide slats) are raised with all the slats **213** tilted in a normal closed position (i.e., downwardly-inclined from front to rear), then initially the lowest slat **213A** will be tilted towards its fully open (i.e., horizontal) position while the nineteen slats (not shown in FIG. **7**) just above the lowest slat will have a gradually less open position of tilt as the height of each slat above the lowest slat becomes greater, and the uppermost slat of the twenty lowest slats of the blind will still be tilted closed, as will the remaining slats (not shown in FIG. **7**) of the blind above the lowest twenty slats.

This invention is, of course, not limited to the above-described embodiments which may be modified without departing from the scope of the invention or sacrificing all of its advantages. In this regard, the terms in the foregoing description and the following claims, such as "longitudinal", "lateral", "length", "horizontal", "vertical", "above", "below", "upwardly", "downwardly", "top", "bottom", "front", "rear", "right" and "left", have been used only as relative terms to describe the relationships of the various elements of the venetian blind of the invention.

For example, each engaging collar **25** of the blind **1** could be replaced by a clip which has one or more, vertically-extending passages, through which one of the blind's rear vertical members **17, 19** and its associated auxiliary tilt cord **14, 15** or just one of the auxiliary tilt cords pass. The collar **25** could also comprise two generally C-shaped halves which could be connected to each other about its associated auxiliary tilt cord **14, 15**.

Similarly, the function of the guiding loops **21** of the blind **1** could be incorporated into the engaging collars **25**. In this regard, a plurality of collars **25** could be slidably mounted